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Energy Centre Summer School

Hedging risk for generators/retailers

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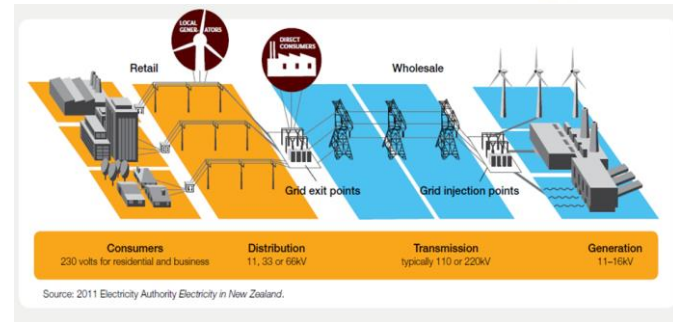
Energy Trading

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Outline

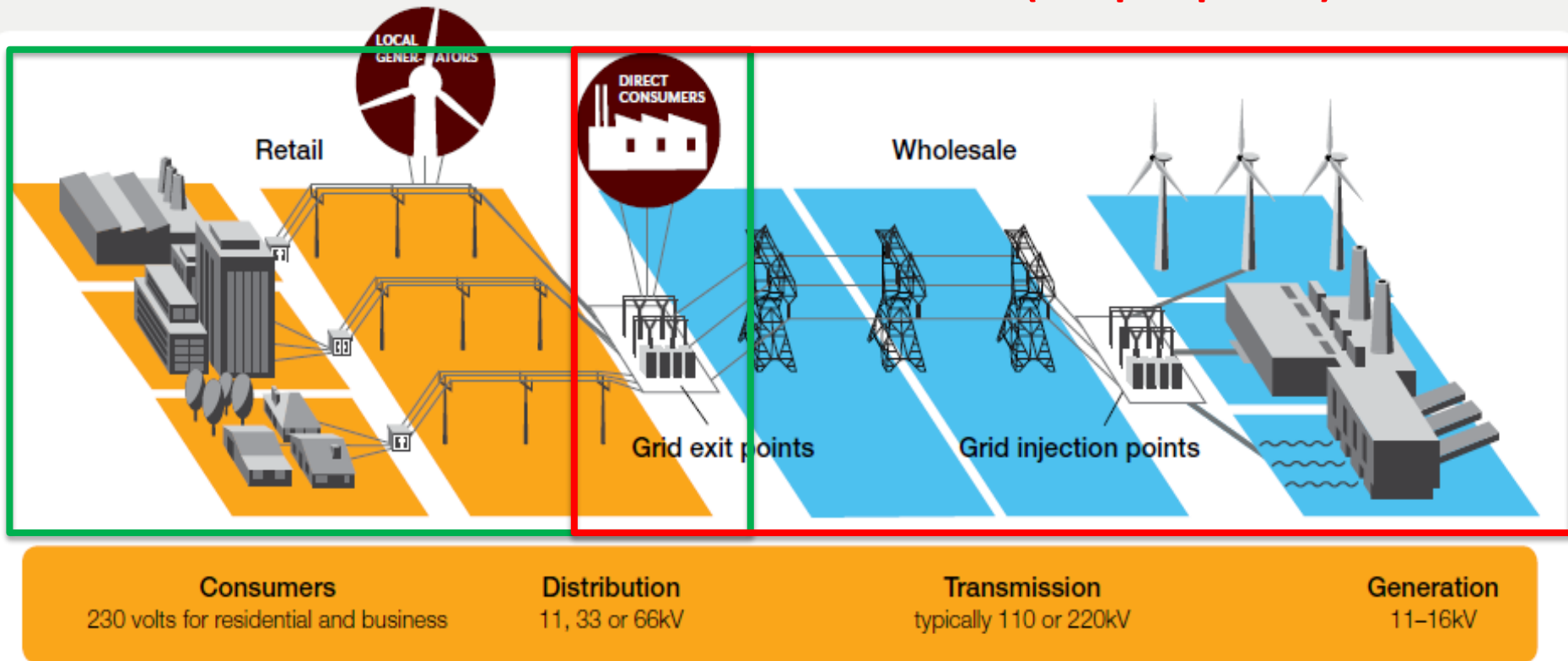
1. Review role of “spot market”
2. Explain retailer/generator interactions with spot market
3. Show how “spot risk” arises
4. What is a hedge ?
5. Show how hedges can reduce spot risk
6. Conclusions and questions



The Market(s)

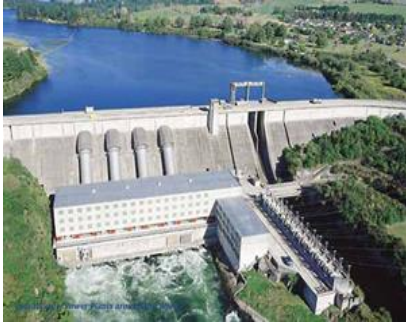
Retail (= “fixed price”) market

Wholesale (= “spot price”) market



Source: 2011 Electricity Authority *Electricity in New Zealand*.

Role of the wholesale (spot) market

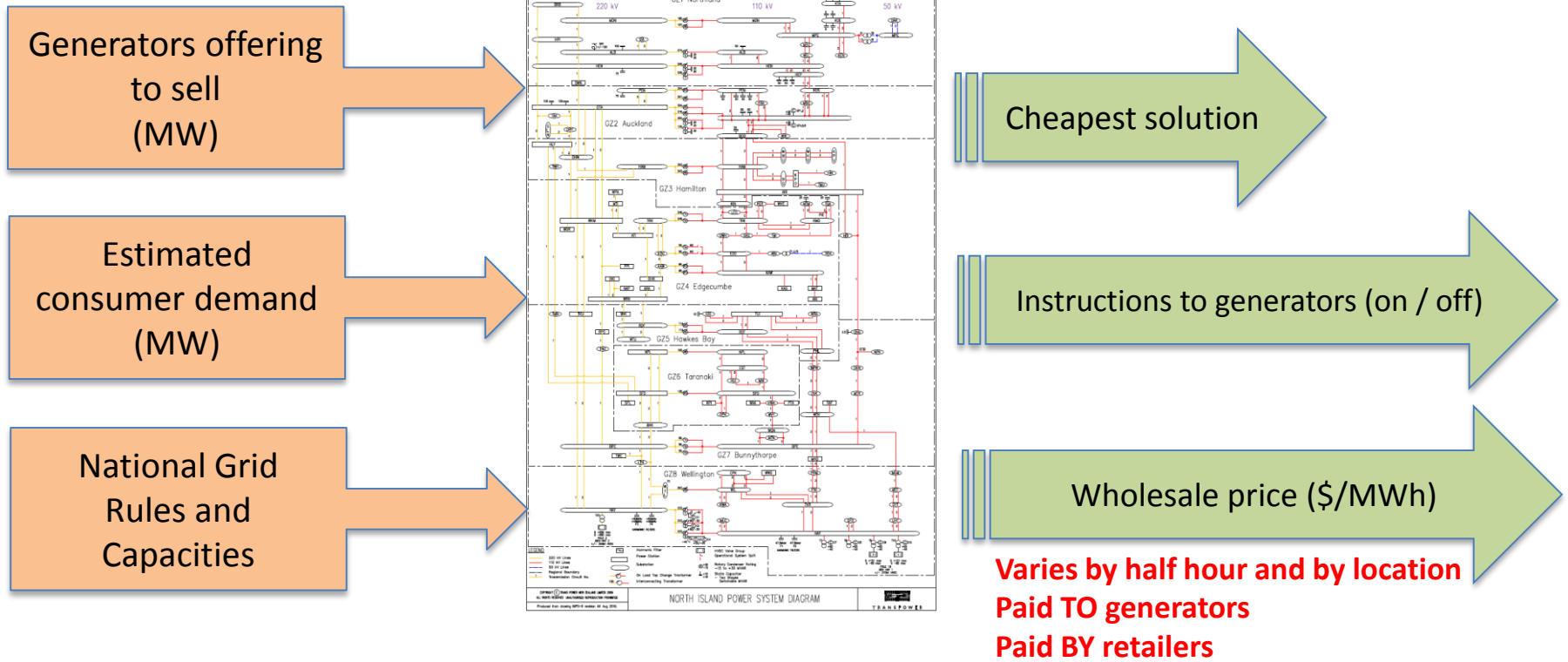


The primary role of the wholesale market is to work out which power stations to run, when, to keep the lights on

Spot Pricing Engine – “SPD”

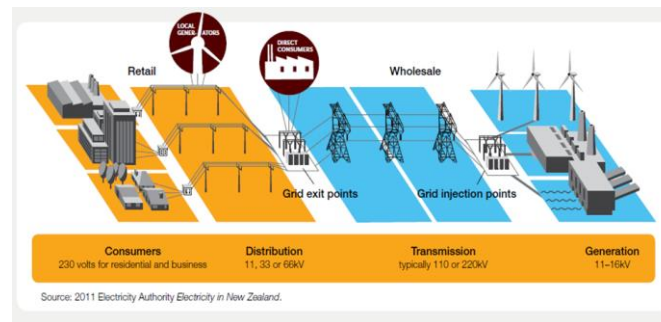


Auction / Pricing System



Role of the wholesale (spot) market

1. Maintain supply / demand balance (keep lights on)
2. Use most efficient (lowest cost) generation first
3. Set correct price at 250+ nodes x 48 half-hour periods / day
4. Facilitate “Gross Pool” market payments
 - all **generators sell** into spot market (**receive** spot price)
 - all **retailers buy** out of spot market (**pay** spot price)



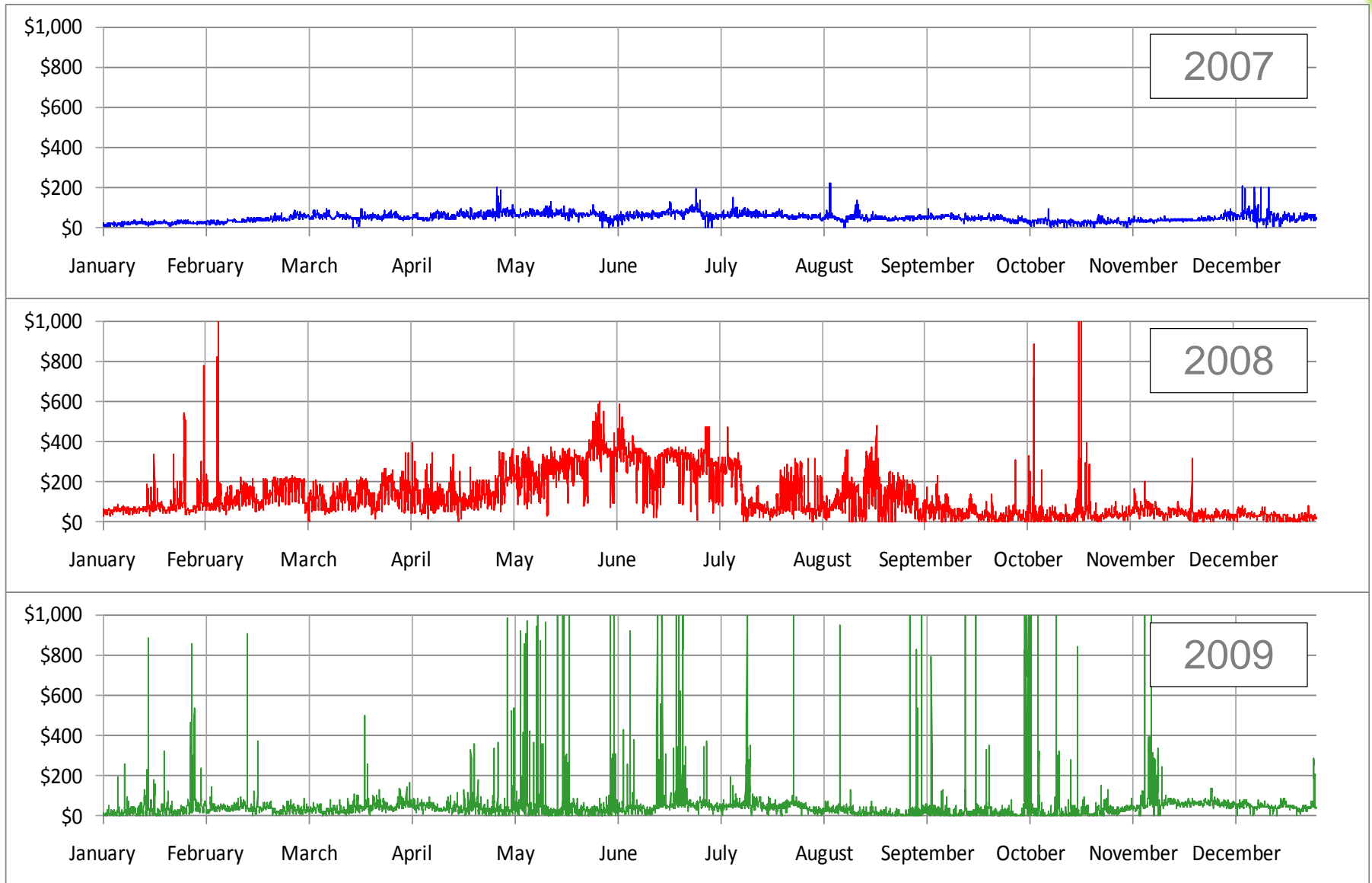
Market(s) : Wholesale versus Retail prices

	\$/MWh	c/kWh
Wholesale electricity (spot, volatile)	70-80 avg Could be \$10K + !	7-8
Risk markup	↓	↓
Retail electricity cost (fixed each year)	100	10
Other charges (transmission, distribution, levies, metering, profit, GST etc)		12 - 20
Delivered rate to customer		22-30

*Customer is protected against
spot price volatility*



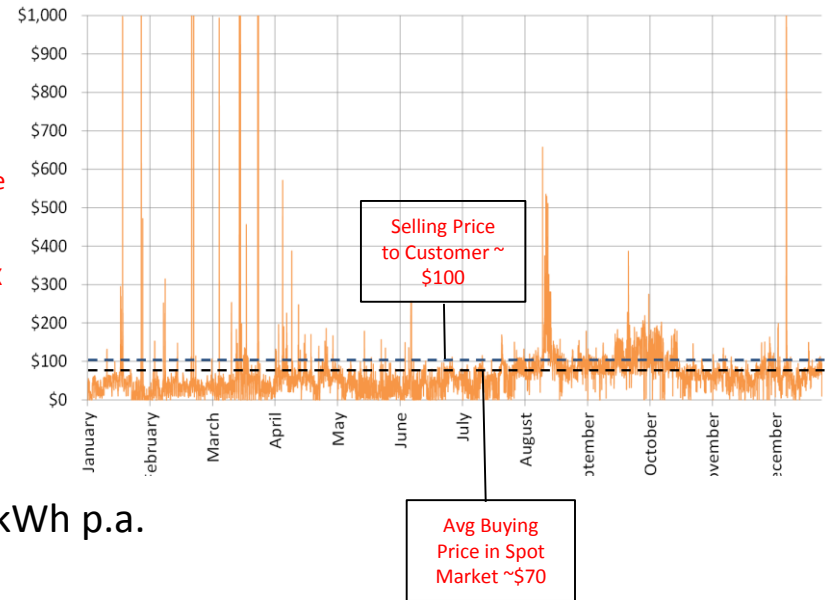
Spot Prices can be volatile : yearly



Retailer example

Sales bring “spot risk”

Spot price
by HH
\$/MWh
at Node X



eg Retailer A acquires 1000 customers, each using 8000 kWh p.a.
= approx 1 MW of load (on average),

and sells to customer at fixed price, (say) 10c/kWh energy = \$100/MWh

must buy load from spot market via Clearing Manager, expect a cost of around \$70/MWh (on average)

expected “gross margin” = +\$30/MWh = +\$240 pa per customer = +\$20 per customer per month

But how do you manage the “spot risk” ?

eg spot market reaches \$300/MWh, lose \$144K / month = **loss of \$144** per customer per month

$$(1 \text{ MW} \times 24 \text{ hrs} \times 30 \text{ days} \times (\$100 - \$300)) = \text{loss of } \$144\text{K total per month}$$

HEDGING

Retailer buying (or Generator selling) or in spot market faces price risk.

Costs may exceed revenues.

Risk Management can be achieved by “hedging”

What is a Hedge ?

“ investment made to limit loss”

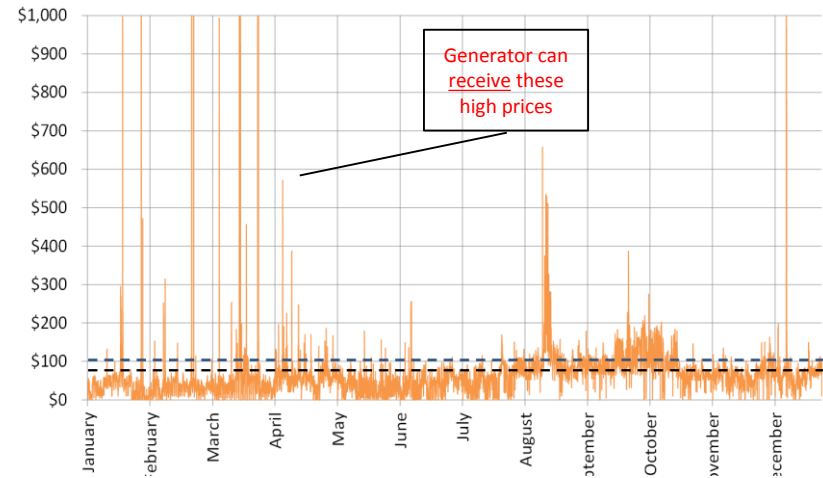


In electricity, hedge types include :

- Physical hedging (eg, vertical integration)
- Financial hedging (eg futures market)

Vertical integration

Portfolio of generation allows lower-risk retailing : how ?



Produce the same quantity (1 MW) of generation

Sell 1 MW generation into spot market, receive the high spot prices, offsetting the high load costs

So Generation has reduced risk for Retail and vice versa.

- Why “vice versa” ?
 - *Because a generator without retail faces the risk of LOW spot prices*
 - *So with retail, the generator now has a hedge provided by customers paying a fixed price*
- Does the retailer have to own the generator ?
 - *Not necessarily, but must have an arrangement with the generator to be paid the spot price, at least when spot price is above a certain level*
 - *This price level is called the “hedge price” or “strike price”.*
 - *If R and G are related parties, = “transfer price”.*

Vertical integration example :

Retail Sales + Wind Generator

eg Retailer A acquires 1000 customers
= approx 1 MW of load (on average)

And buys a wind turbine, rated 3 MW, but produces 1 MW on average

Is wind a good “physical hedge” ?

What are the risks ?

How would you hedge those risks ?



Spot Market



Risk Analysis for 'Retail + Wind' Genterailer

Risks

Volume : Timing : Location (V:T:L)

- **V** : Wind may not produce 1 MW on average
- **V** : Wind will not respond at all to change in customer load (no “peaking” ability)
- **T** : Wind may produce 1 MW on average, but at wrong times of day/season
- **L** : Wind will be sold into spot market at different node (may earn less)

Hedging Possibilities (reducing or offsetting the V:T:L risks)

- **V/T** : Ask customers to turn off if wind not blowing ???
- **V/T** : Backup generation – must be reliable, eg diesel generators
- **V/T** : Wind insurance (pay a premium to receive \$ when wind not blowing)
- **V/T** : Cap instrument (eg pay a premium to receive \$ if price goes high)
- **T** : Battery storage of wind output ? Time shift the generation to match load
- **L** : Locational hedges eg FTRs (covers nodal location risk)



Spot
Market



Summary of Hedging Products in NZ

Physical

- Vertical integration (own retail + own generation) – such as wind example
- PPAs (Power Purchase Agreements : buy someone else's generation output at a fixed price)

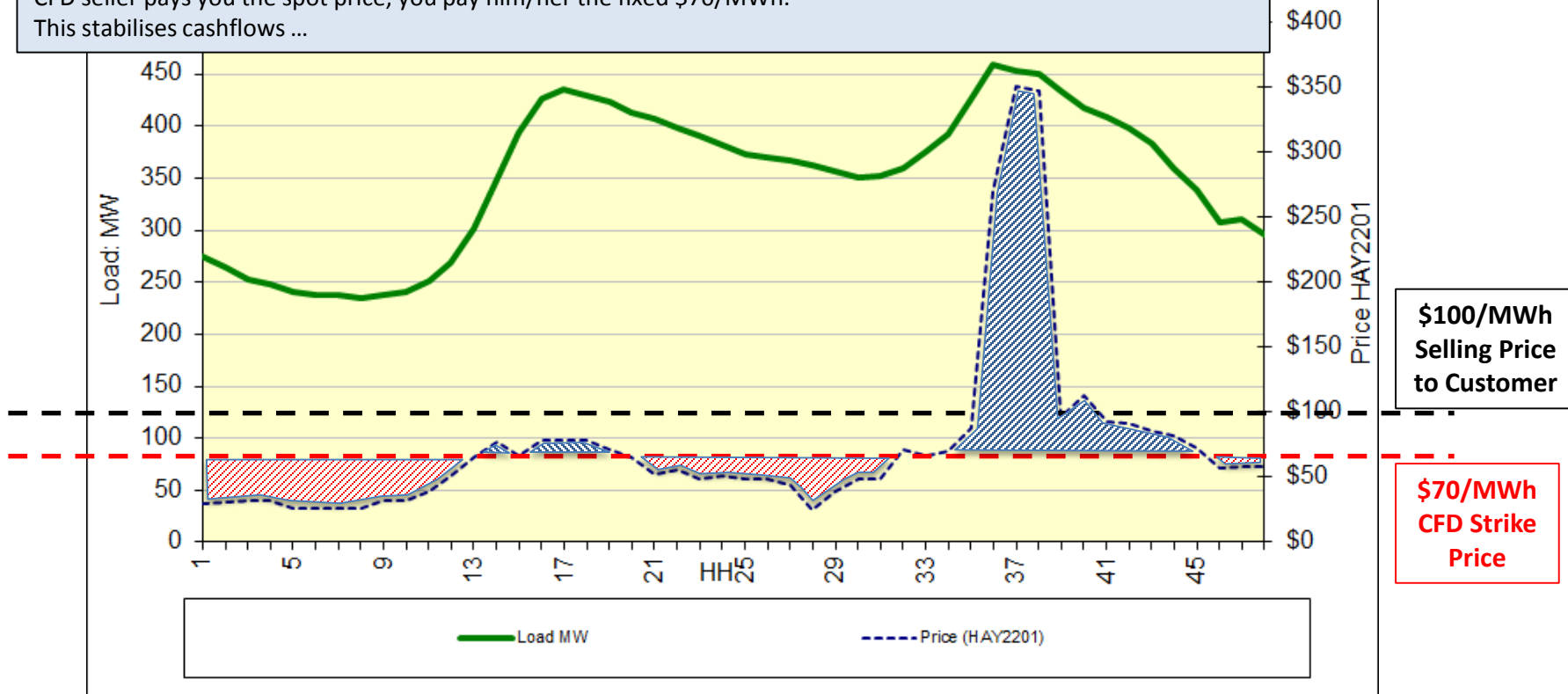




Financial (Derivatives)

- Contracts for Difference (CFDs) : 2 parties are each trading with the spot market, but also enter into a CFD:
 - Buyer of CFD pays hedge price to seller (eg \$70/MWh)
 - Seller pays spot price to buyer (could be anything, eg \$300/MWh)
 - Settle each month on the difference (eg \$230/MWh seller pays buyer). Might be either way.
 - Buyer (retailer) net cost = spot market \$300 less CFD \$230 = \$70
 - Seller (generator) net revenue = spot market \$300 less CFD \$230 = \$70
 - Both buyer and seller are now “hedged at \$70”. Overall, immune to the spot price.
- Exchange Traded Futures (ETFs), on Australian Securities Exchange (ASX) at Benmore or Otahuhu
- Financial Transmission Rights (FTRs), between Benmore/Otahuhu/Invercargill/Haywards/Islington
- Exotic Instruments : Caps, Options, Swaptions, Weather Insurance, etc (many variations)

Financial CFD Hedging example

Hedge your spot costs by buying a bilateral CFD at \$70/MWh, while also selling to customers at \$100/MWh fixed price.
 CFD seller pays you the spot price, you pay him/her the fixed \$70/MWh.
 This stabilises cashflows ...

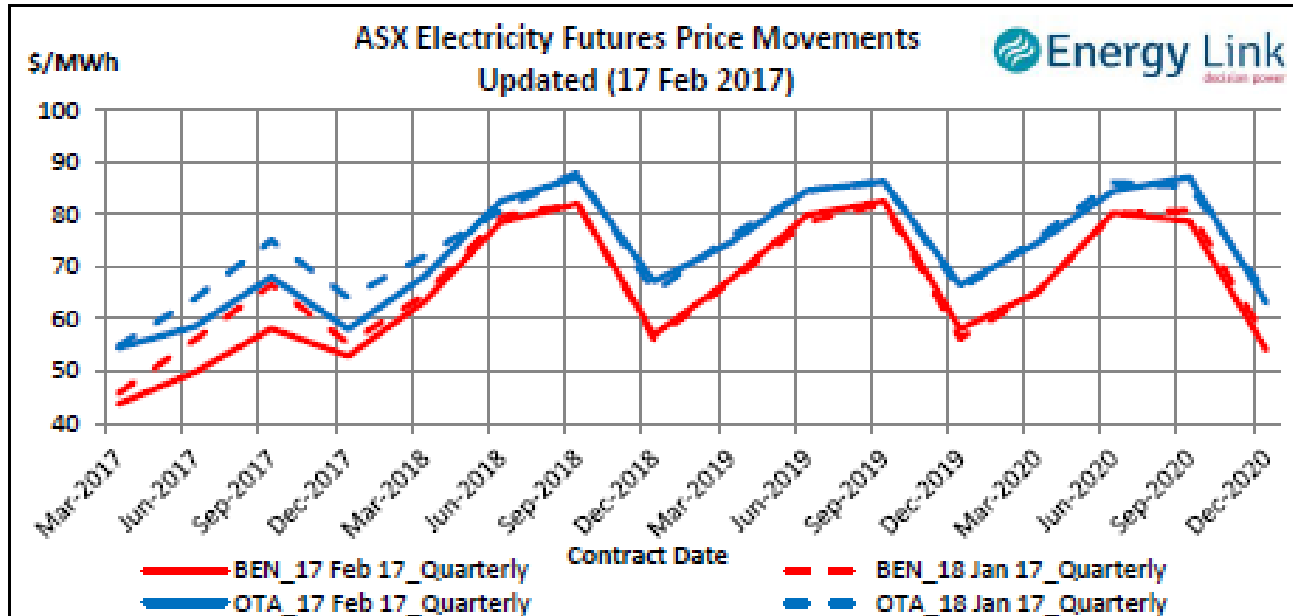


-  CFD Seller pays you this difference
-  You pay CFD Seller this difference

Net Effect :
 You are protected against high spot prices, but forgo the benefit of low spot prices.
 Overall, stabilise gross margin at +\$30/MWh
 PROVIDED you have a "load following CFD" at same node !
 (What would happen if you have a "Baseload CFD" ? Or CFD at different node ?)



“Futures” market hedges (similar to a CFD)



You can “buy forward” for a fixed hedge price from a seller on the futures market.

Note : if you are purchasing physical power for your customers you still have to pay the spot price on the day, but you settle up later by receiving spot price from the seller of the futures product.

Similar to a CFD but traded on a live market in standard quantities (0.1 MW x 1-3 months), with “market makers” and margin calls to eliminate counterparty risk.

Acknowledgement : Energy Link Limited

Review

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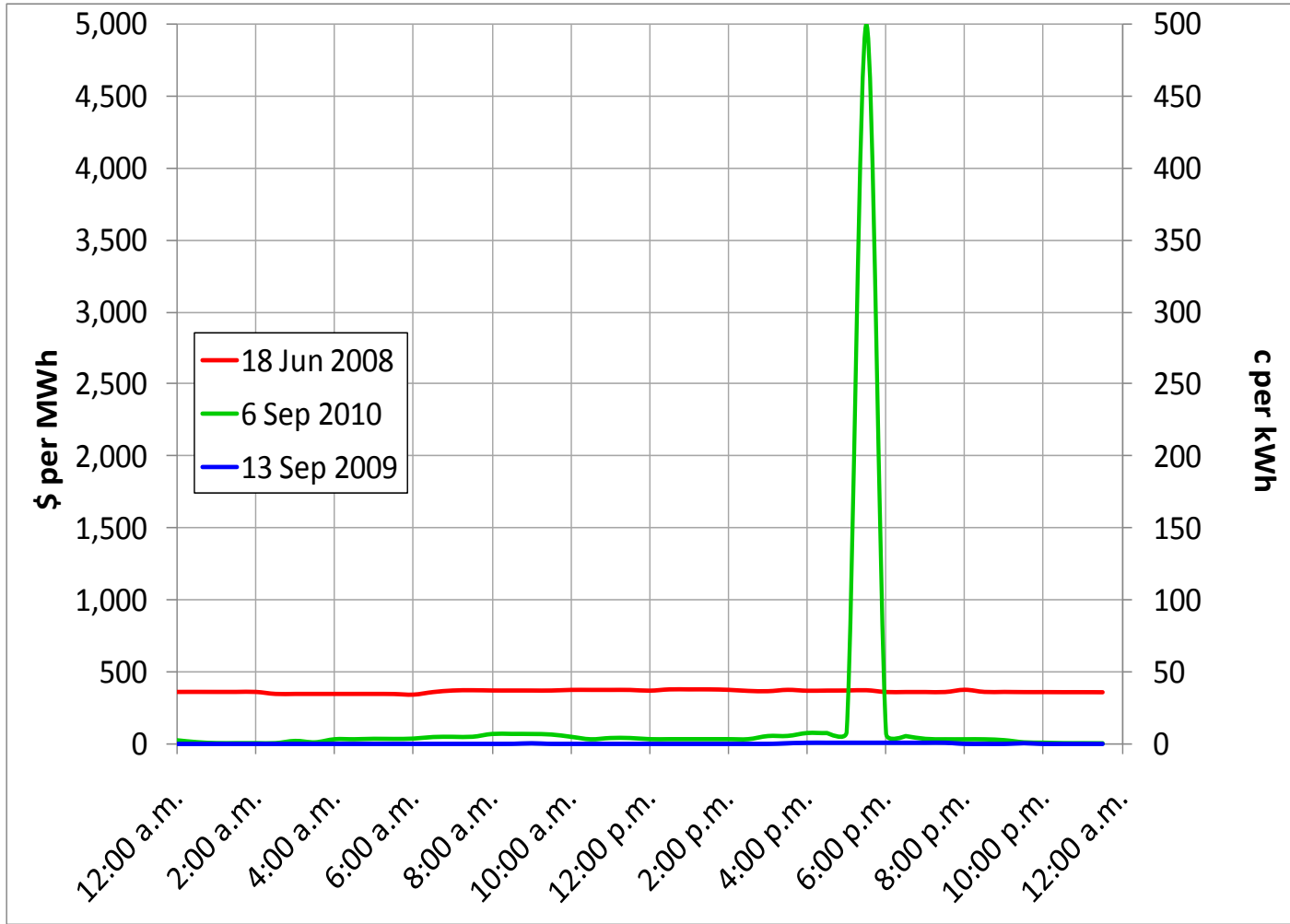


Spot Market



Spare slides

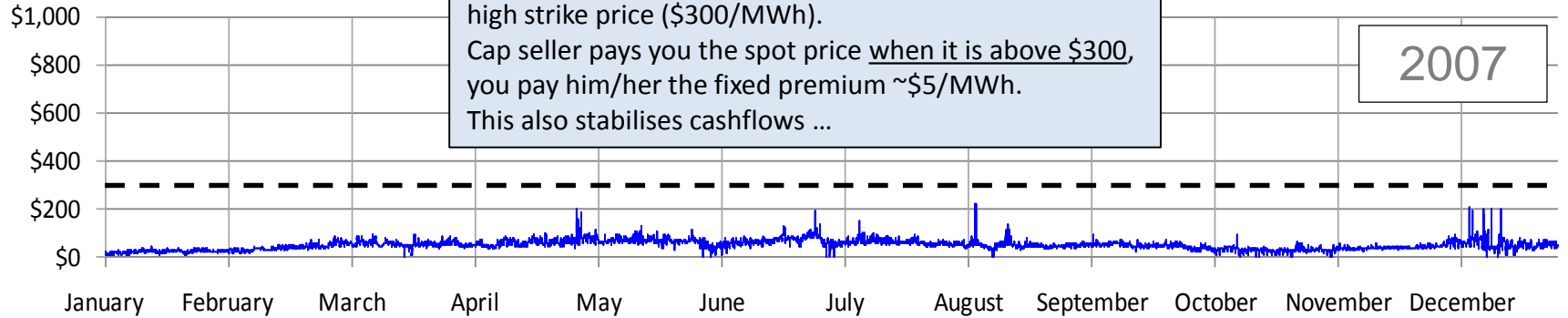
Spot Prices can be volatile : daily



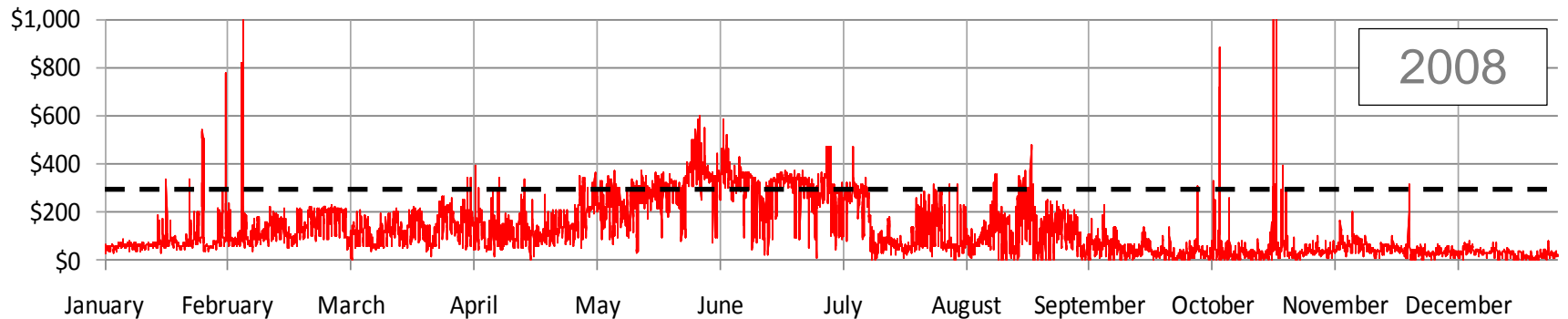
Cap hedging example (like a one-sided CFD)

Hedge your spot costs by buying a “cap hedge” with a high strike price (\$300/MWh).
Cap seller pays you the spot price when it is above \$300,
you pay him/her the fixed premium ~\$5/MWh.
This also stabilises cashflows ...

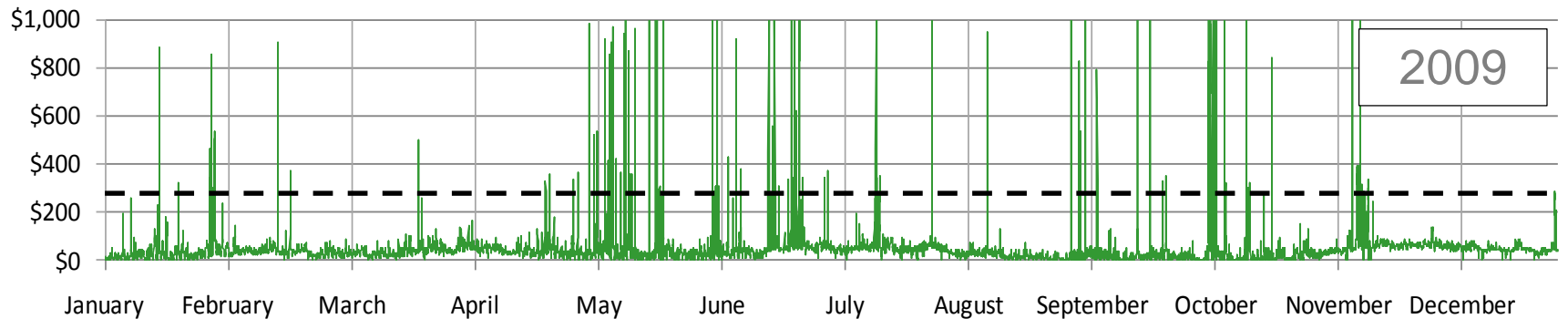
2007



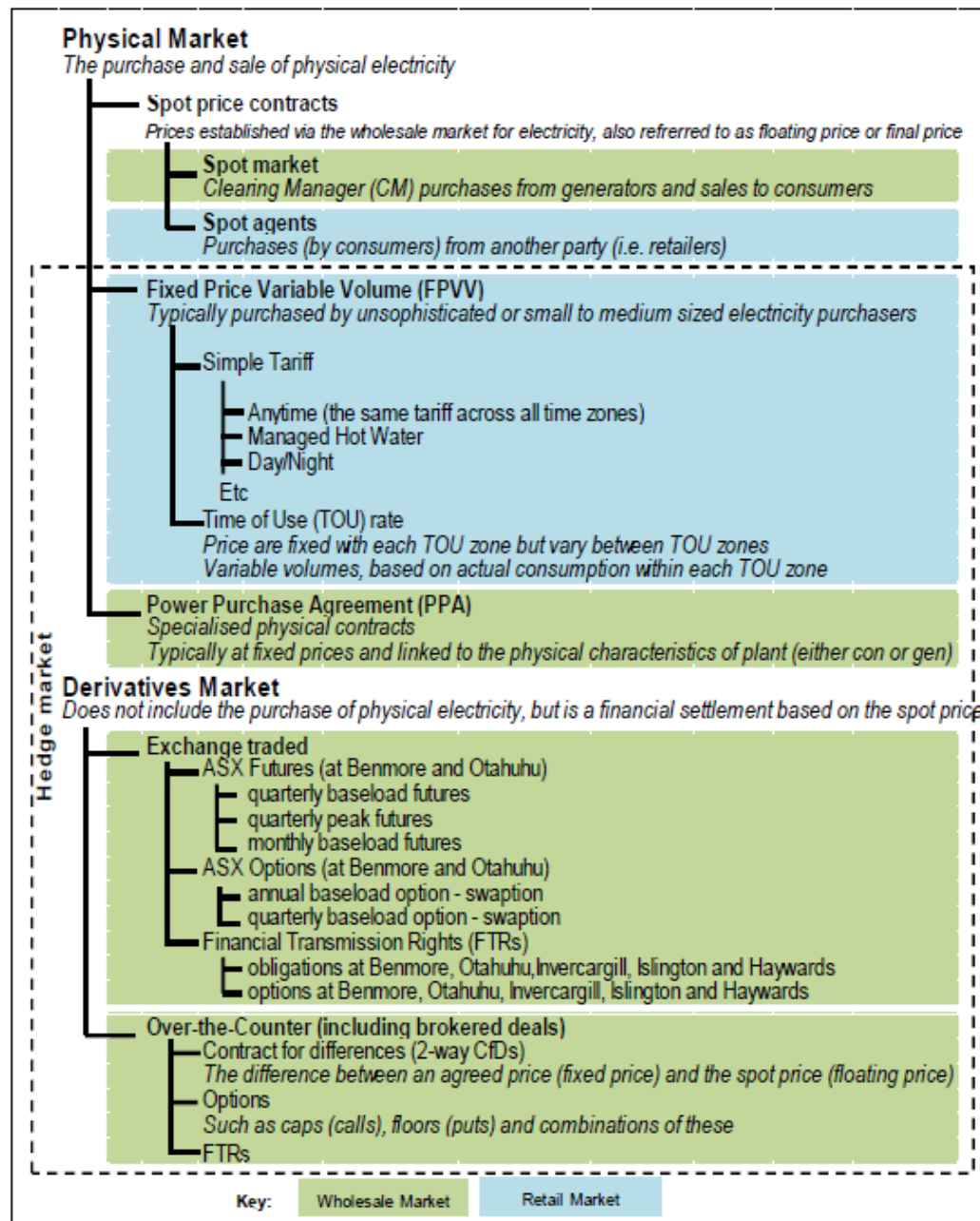
2008



2009



View of market instruments



(Source : Electricity Authority
Wholesale Advisory Group
June 2015)